

WHAT IS CLAIMED IS:

1. A system for multi-element substantially real time chemical analysis of aerosol particles, comprising:

a particle concentrator unit having an input for receiving initial particle-laden air flow and an output for discharging therefrom a concentrated air flow containing droplets obtained by condensational growth of said initial particles,

a real impactor having an inlet and an outlet, said real impactor receiving at said inlet thereof said concentrated air flow from said particle concentrator unit and discharging from said outlet thereof a liquid slurry containing said droplets, and

means for multi-element analysis of said liquid slurry received from said real impactor.

2. The system of Claim 1, further comprising a fraction collector coupled to said outlet of said real impactor, said fraction collector including a plurality of sample vials for filling said liquid slurry into at least one sample vial for an off-line analysis by said means for multi-element analysis.

3. The system of Claim 1, wherein said outlet of said real impactor is directly coupled to said means for multi-element analysis for on-line analysis.

4. The system of Claim 1, wherein said particle concentration unit includes:

a saturator receiving said initial particle-laden air flow and a stream flow, and discharging a saturated said particle-laden air flow containing said initial particles,

a condenser coupled to said saturator for receiving said saturated particle-laden air flow and condensationally growing said initial particles in diameter thereof to produce said droplets, and

a virtual impactor coupled to said condenser for receiving therefrom the air flow laden with said droplets and for separating therefrom the droplets exceeding a predetermined diameter thereby obtaining said concentrated air flow containing said droplets.

5. The system of Claim 1, further comprising a steam generator producing a flow of steam supplied to said saturator.
6. The system of Claim 4, wherein said initial particle-laden air flow is supplied to said saturator at the flow rate in the approximate range 170-260 L/min.
7. The system of Claim 6, wherein said flow rate of said air flow is approximately 200 L/min.

8. The system of Claim 5, wherein said flow of steam is supplied to said saturator at the flow rate not exceeding 6 L/min.

9. The system of Claim 4, further comprising a controllable heater coupled to said saturator to heat the same to a predetermined temperature.

10. The system of Claim 4, further comprising cooling means coupled to said condenser for maintaining walls thereof at a predetermined temperature.

11. The system of Claim 10, wherein said predetermined temperature of the walls of said condenser is in the approximate range of 0.5°C - 10°C.

12. The system of Claim 7, wherein the flow rate of the air flow laden with droplets received at said virtual impactor is approximately 170 L/min.

13 The system of Claim 4, wherein said virtual impactor divides said air flow into (a) a minor flow of air from said air flow, said minor flow of air containing said droplets exceeding the predetermined diameter, and (b) a major flow of air.

14. The system of Claim 13, wherein said minor flow of air is supplied to said real impactor with the approximate flow rate of 10 L/min.

15. The system of Claim 13, wherein said major flow exits said virtual impactor with the flow rate of approximately 190 L/min.

16. The system of Claim 1, wherein said means for multi-element analysis includes Graphite Furnace Atomic Absorption Analyzer.

17. The system of Claim 4, wherein said predetermined diameter is within the approximate range of 0.7-12 μm .

18. The system of Claim 2, wherein said liquid slurry is expelled from said real impactor approximately every 30 minutes.

19. The system of Claim 4, wherein a residence time of said droplets within said condenser is in the range 0.03 sec. - 0.6 sec.

20. A method of multi-element analysis of aerosol particles, comprising the steps of:

supplying a flow of ambient air laden with initial particles to a saturator,

injecting a flow of steam to said saturator for being mixed with said ambient air and for saturating the same,

directing the saturated ambient air from said saturator into a condenser for condensational growth of said initial particles thereby producing an air flow laden with droplets of a diameter larger than diameters of said initial particles,

supplying said air flow laden with said droplets to a virtual impactor, for separating from said air flow a concentrated air flow containing said droplets exceeding a predetermined diameter,

directing said concentrated air flow from said virtual impactor to a

real impactor for forming a liquid slurry containing said droplets of said exceeding diameter, and

exposing said liquid slurry to a multi-element analysis.

21. The method of Claim 20, wherein said liquid slurry is delivered to a sample vial prior to said multi-element analysis for off-line analyses.

22. The method of Claim 20, wherein said liquid slurry is supplied directly from said real impactor to a multi-element analysis means for on-line analyses.

23. The method of Claim 20, wherein said liquid slurry is analyzed by a graphite furnace atomic absorption spectrometer.